Hybrid Solar Electricity Systems

BREATHE Systems® Solar Electricity Systems cannot only compete with retail energy sources but can also generate income from utility company feed-in tariffs.

Given the ever-increasing costs of energy, it is widely foreseen that solar energy will become a common entity to every residential and commercial building. In proportion to high energy costs in most regions of the world, the payback time on the initial investment into a solar electricity system is often only a few years. This results in a zero-risk investment.

Hybrid Systems are ideal for regions where there may be major fluctuation of electricity or an unstable energy source. Hybrid systems are preferable to off-grid systems as they can work both on-grid and off-grid therefore not limiting application. Also, hybrid systems are the obvious choice for remote locations.

Various countries offer government subsidies towards purchasing the system. Utility companies in many regions of the world offer competitive feed-in tariff rates making it quicker to pay off the initial investment and generate income from excess electricity produced.

BSS-2kWHSES - 2kW Hybrid Solar Electricity System

Components	Description	Quantity	Page
SE0200M-CG	200W Monocrystalline Photovoltaic Panel	10	2
SE-JB01	PV Junction Box	2	3
SE-PV6	PV Combiner Box	1	4-11
SE-PVB15	15Amp Breaker	4	7
SE-PVB63	63 Amp Breaker	2	7
MX60	Outback Charge Controller	1	12
SE-12RADG260	Battery - GEL Deep Cycle	8	13-14
GTFX2524-PKG	2kW Outback Hybrid Photovoltaic Inverter Package	1	15-29
SE-LA302-DC	DC Lightning Arrestor	2	30
SE-LA302-AC	AC Lightning Arrestor	1	31
SE40XLPOTPEU	4.0mm2 XLPO TPEU TüV Photovoltaic Cable (1Quantity = 1m)	110	32
SE05RMS	BREATHE Systems® Roof Mounting System (5 Panels per Row)	2	33-37

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& efficient alternatives
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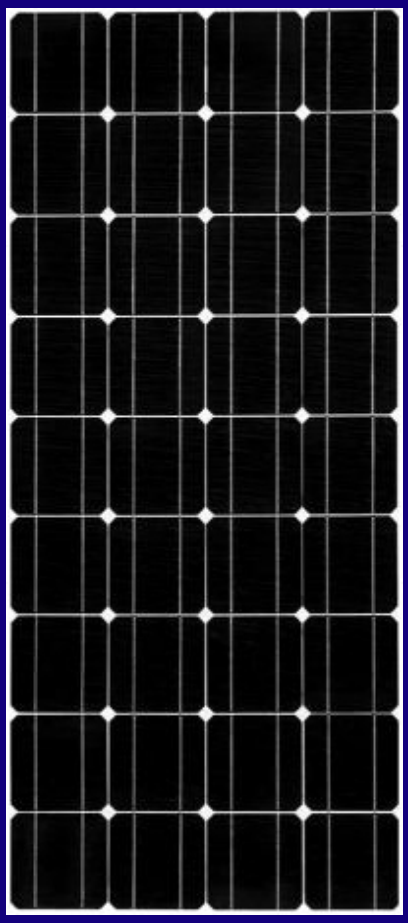
Monocrystalline Photovoltaic Panel

SE0200M-CG

The SEM-CG Series are designed and built to deliver the highest efficiency and reliable power for residential and commercial solar systems. Relying on the stringent manufacturing standards and latest PV technology, the module provides the highest possible energy output per watt with total module efficiency of more than 12.5%.



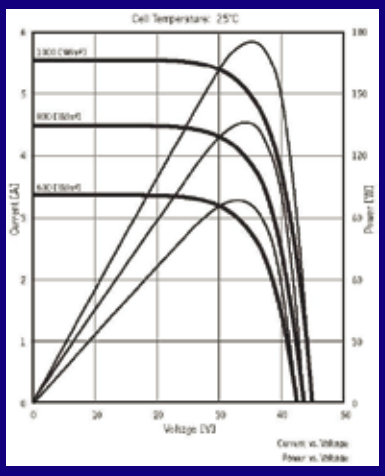
Superior conversion rate and exceptional low-light performance enable it to deal with the most challenging conditions of military, utility, residential and commercial installations. The module is the perfect choice for those who demand outstanding performance and exceptional uniform appearance.

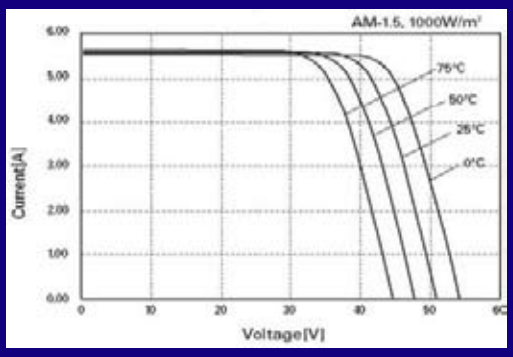
Features and benefits

- High efficiency of more than 12.5%
- Negative Tolerance Rating of 3%
- Nominal 24 V DC for standard output
- Outstanding low-light performance
- High transparent low-iron, tempered glass
- Aluminum Frame
- Unique techniques give the panel the following features: aesthetically pleasing appearance, withstands high wind-pressure and snow load, and easy installation
- Unique technology ensures that problems of water freezing and warping do not occur
- Designed to meet unique demand of customers
- 25 year module output warranty

Warranty: - 2 year product warranty; 25 year performance warranty at 80% power

Certifications: - CE; ISO





Electrical Characteristics

Model	SE0200M-CG
Nominal Power	200W
Open-Circuit Voltage (Voc)	32.73V
Optimum Operating Voltage (Vmp)	26.7V
Short-Circuit Current (Isc)	8.24A
Optimum Operating Current (Imp)	7.51A
Maximum Power at STC (Pmax)	200Wp
Operating Temperature	-40ºC to 85ºC
Maximum System Voltage	1000V DC
IP Device Grade	IP365

(STC: Irradiance 1000W/m2, Module Temperature 25ºC, AM=1.5)

Specifications

Cell	Monocrystalline Silicon Solar Cells
Dimension of Module	1498mm x 999mm x 48mm
Weight	20.6kg

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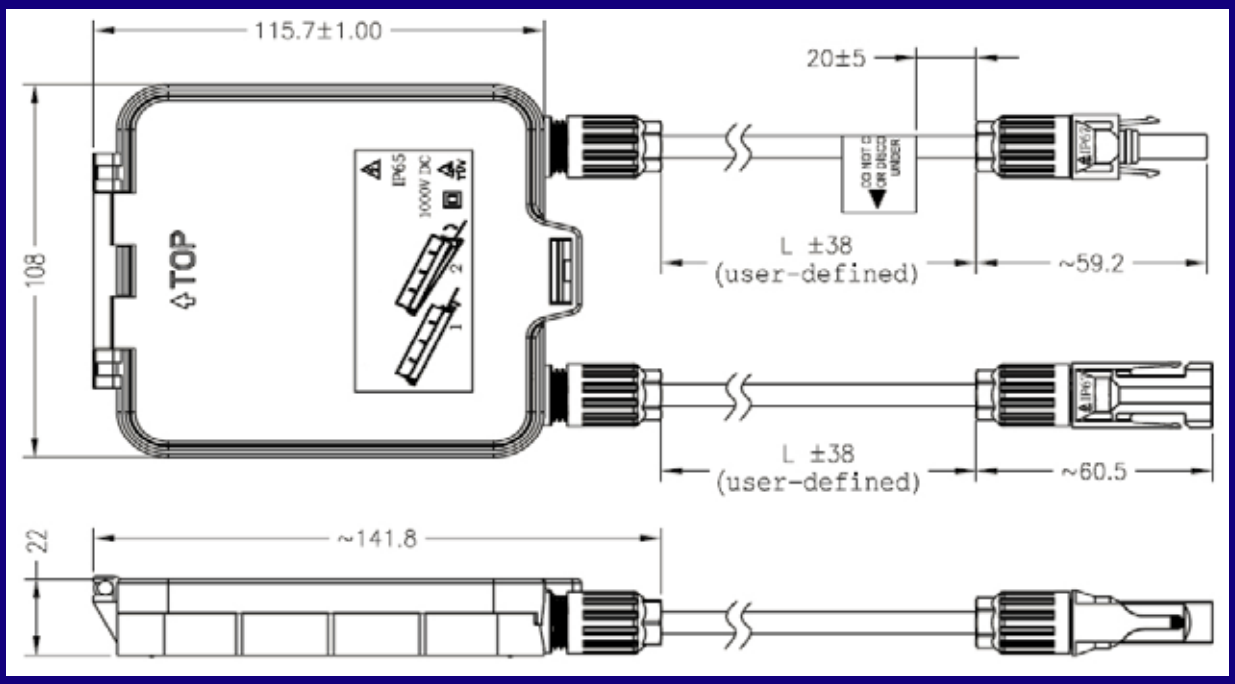
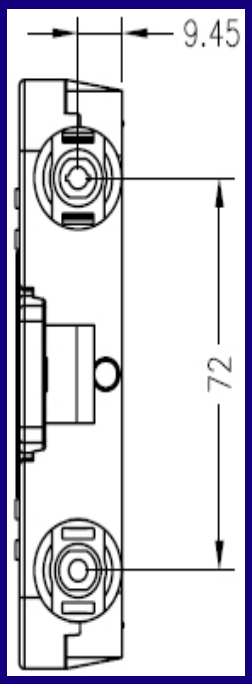
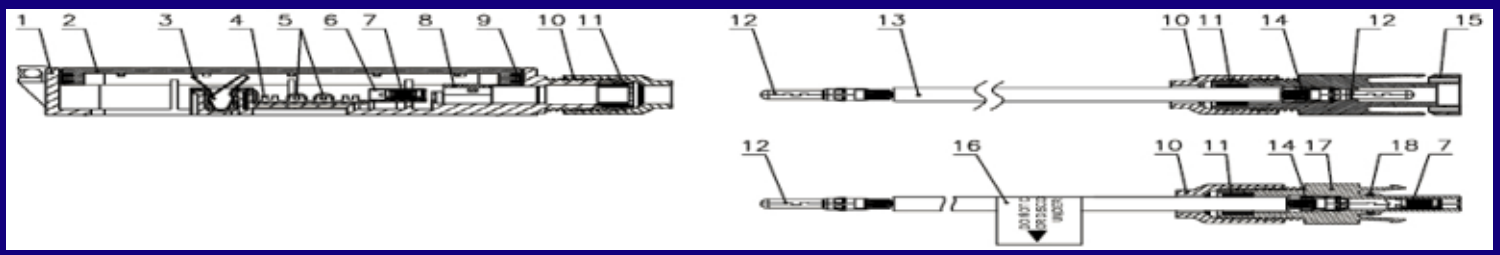
Junction Box

SE-JB01







BILL OF MATERIALS

No.	Product Name	Q'TY	Colour	Material	Certificatetion
1	Housing	1	Black	PPO, UL94 V-0	UL, QMFZ2. E45587
2	Cover	1	Black	PPO, UL94 V-0	UL, QMFZ2. E45587
3	Shrapnel	4	White	Stainless Steel	SGS, Test Report: NO. SH522843/CHEM
4	Terminal Base	4	White	Copper. Plating Sn	SGS, Test Report: NO. GZSCR0512104041/CHEM
5	Diode	3	Black		
6	Female terminal	2	White	Copper. Plating Sn	SGS, Test Report: NO. GZSCR0512104041/CHEM
7	Drum terminal	3	White	Be Copper. Plating Sn	Be Cuprum. Plating Sn
8	Fasten	2	Black	PPO, UL94 V-0	UL, QMFZ2. E45587
9	Seal	1	Black	Silicon	UL, QMFZ2. E231325
10	Turncap	4	Black	PPO	UL, QMFZ2. E45587
11	Sealed tube	4	Black	EPDM	
12	Male terminal	3	White	Copper. Plating Sn	SGS, Test Report: NO.GZSCR0512104041/CHEM
13	Cable	2	Black	Copper. PVC	
14	Shrapnel	2	White	Stainless Steel	SGS, Test Report:NO.SH522843/CHEM
15	Male Connector Housing	1	Black	PPO	UL, QMFZ2. E45587
16	Label	1	White	PVC	SGS, Test Report: NO. GZ0803024403/CHEM
17	Female Connector Housing	1	Black	PPO	UL, QMFZ2. E45587
18	"O" RING	1	Red	Silicon	UL, QMFZ2. E231325

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SE-PV3 / SE-PV6 Combiner Box & SE-PVB Breakers

The SE-PV3 & SE-PV6 Combiner Box is rated for outdoor use. Although designed primarily for combing PV strings up to 150VDC, the SE-PV Combiner Box may be used for combining high voltage strings using fuses. The use of touch safe din rail mount fuse holders and fuses allow operation up to 600 Volts. This high voltage configuration requires a high voltage kit that consists of a bus-bar and insulator to prevent arcing. Although the fuse-holders are already UL listed to 600 volts, Underwriters Laboratories requires additional insulation when using these fuse-holders with PV modules.

Applications

- PV combiner up to six strings using SE-PV breakers rated for 150VDC
- PV combining up to four strings using industry standard touch safe fuse holders rated for 600VDC
- DC load center using SE-PV breakers

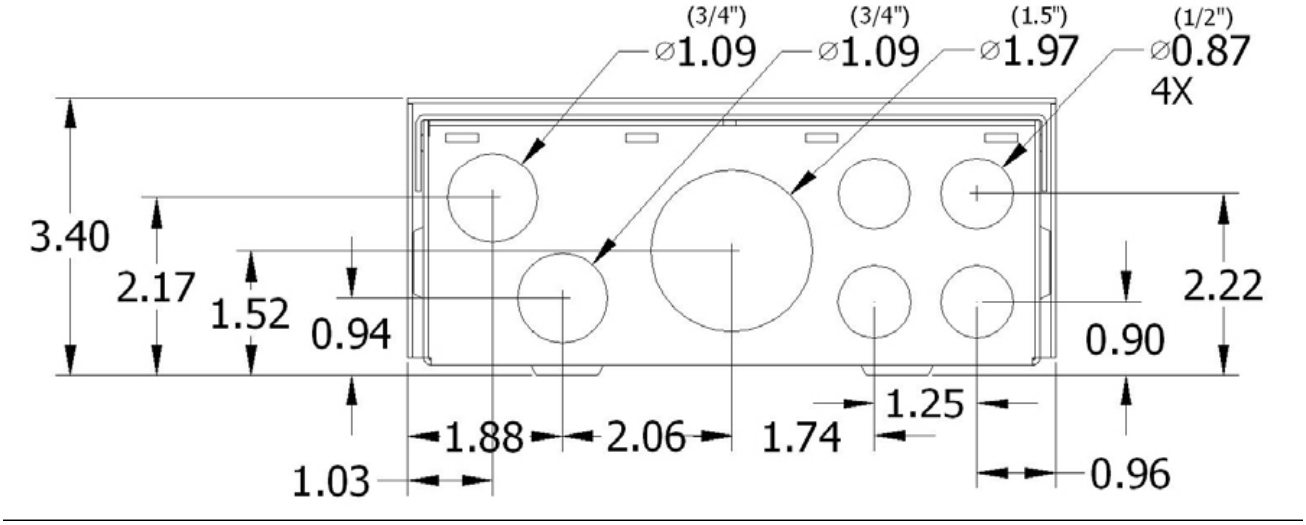
Features

- Aluminum powder coated housing that won't rust
- Flip up cover that can stay in the open position during installation
- PV Negative bus bar with 14 useable openings (10 #14-6 and 4#1/0-14)
- Chassis Ground bus bar with 14 useable openings (10 #14-6 and 4#1/0-14)
- Standard din rail to mount up to 6 breakers or 4 fuse holders
- Tin plated copper bus bar to combine breaker outputs (may be split in two)
- Dead front cover snaps into place for safety after wiring is complete
- Knock outs for PV-in and PV-out on bottom and sides
- Top surface is available to bring conduit in from directly above the enclosure

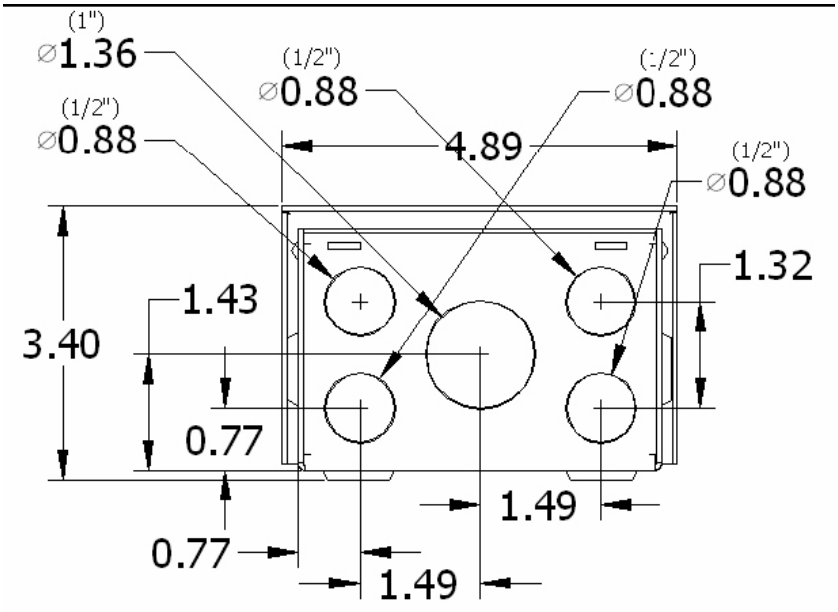
Note: The plastic dead front fits on very tightly; you must pull the cover off in order to remove the dead front.

Installation

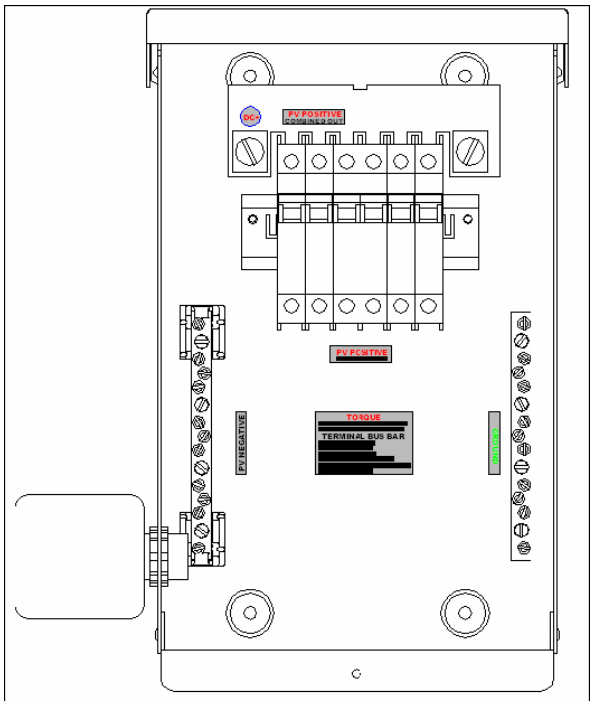
The installation of a PV combiner is fairly straight forward. Firstly select the location to install your combiner. Some systems have the PV modules located close to the inverters and or battery system. If this is the case, you can elect to mount the SE-PV Combiner Box inside and run each PV string down to the SE-PV Combiner Box inside the house. This is convenient for trouble shooting and upgrading. For longer runs the combiner will be mounted outdoors on the pole for pole mounted PV arrays or similar mounting for rack mounted arrays. The combiner can be mounted in the vertical position or slanted backwards to accommodate up to a 3/12 roof pitch. All unused holes should be blocked using a reliable sealant in order to keep rain and bugs out of the enclosure. The following dimensioned drawings show the location and size of knockouts available on the SE-PV3 & SE-PV6 enclosure. Note that on the SE-PV6 the center bottom knock out is sized for a 1 ½" conduit adapter. The bottom left has two knock outs for ¾" conduit and the bottom right has four ½" knock outs. The left and right side each have a ½" knock out for either wire entry or for lightning arrestors. Do not use the side knockouts outdoors as rain may get on terminal bus-bars.



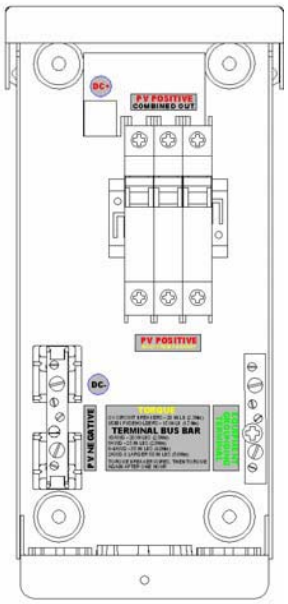
SE-PV6 Bottom conduit locations and sizes



SE-PV3 Bottom conduit locations and sizes

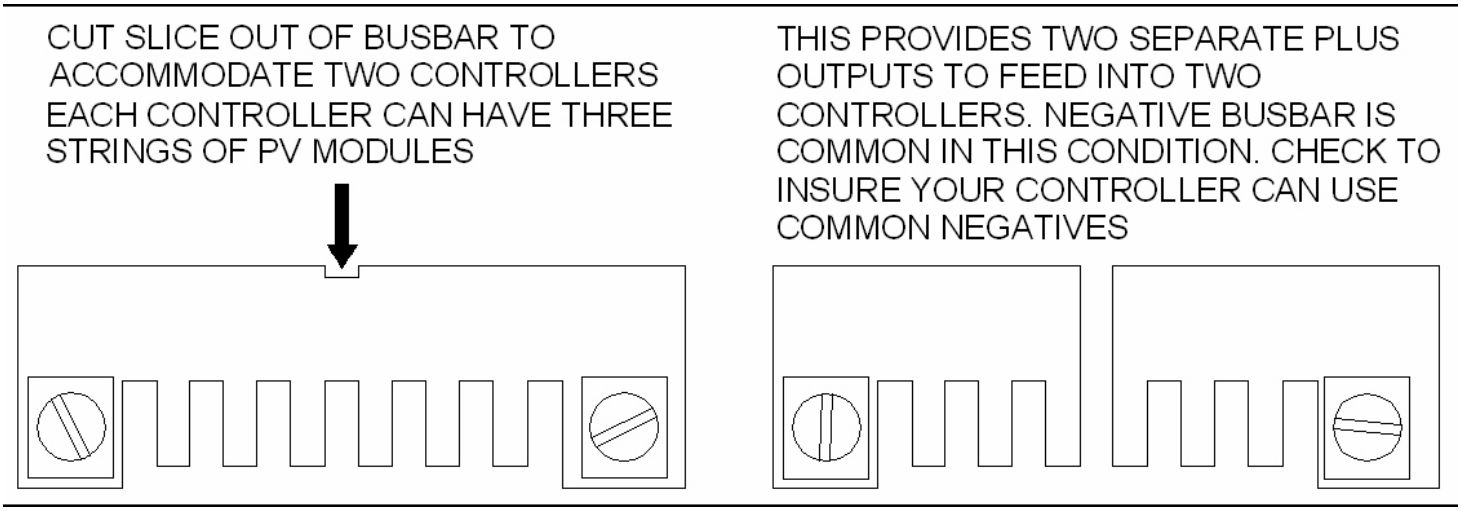


SE-PV6 with Lightning Arrestor



SE-PV3

The SE-PV6 enclosure can be split into two sections. This is sometimes done in 12 and 24V systems where more controllers are required for additional power. For instance in a 24 volt system if a charge controller is used that is limited to 1600 watts of PV per controller. If 130W PV modules are used, you can make three strings of 4 modules in series. This adds up to 1560 watts per controller. That is a good match of PV vs. Controller capability. The SE-PV3 can accommodate this arrangement directly, but the SE-PV6 can accommodate two of these systems, thus saving wiring, space and money. See the following figure on splitting the bus-bar into two systems.


CUT SLICE OUT OF BUSBAR TO ACCOMMODATE TWO CONTROLLERS EACH CONTROLLER CAN HAVE THREE STRINGS OF PV MODULES
THIS PROVIDES TWO SEPARATE PLUS OUTPUTS TO FEED INTO TWO CONTROLLERS. NEGATIVE BUSBAR IS COMMON IN THIS CONDITION. CHECK TO INSURE YOUR CONTROLLER CAN USE COMMON NEGATIVES

When selecting breakers for use with the SE-PV Combiner Box, first check with the PV manufacturer to determine the proper "series fuse". The term fuse is used even though you are probably using breakers. This is a carry over from UL terminology.

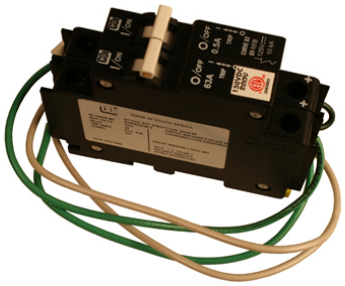
BREAKERS

BREATHE Systems® offers PV Breakers rated up to 150VDC and are available in 15Amps and 63Amps, other sizes are available on special order.

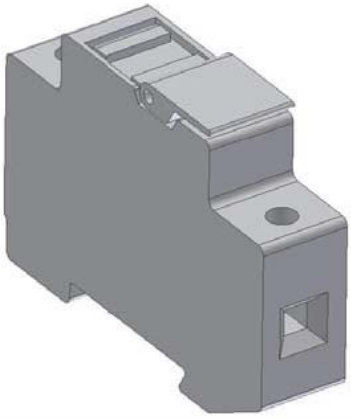
SE-PVB15

SE-PVB63

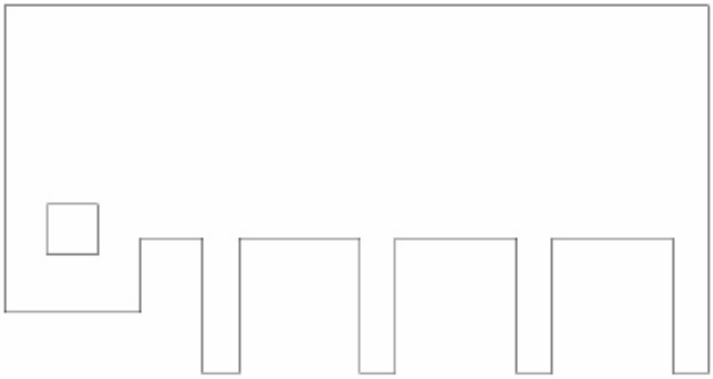
SE-PVB63gfp



The SE-PV6 Combiner Box can also utilize touch safe fuse holders and fuses rated for up to 600 Volts DC for high voltage strings. The SE-PV6 comes with a special bus-bar that has four legs to accommodate four fuse holders.



Fuse safe touch Fuse Holder



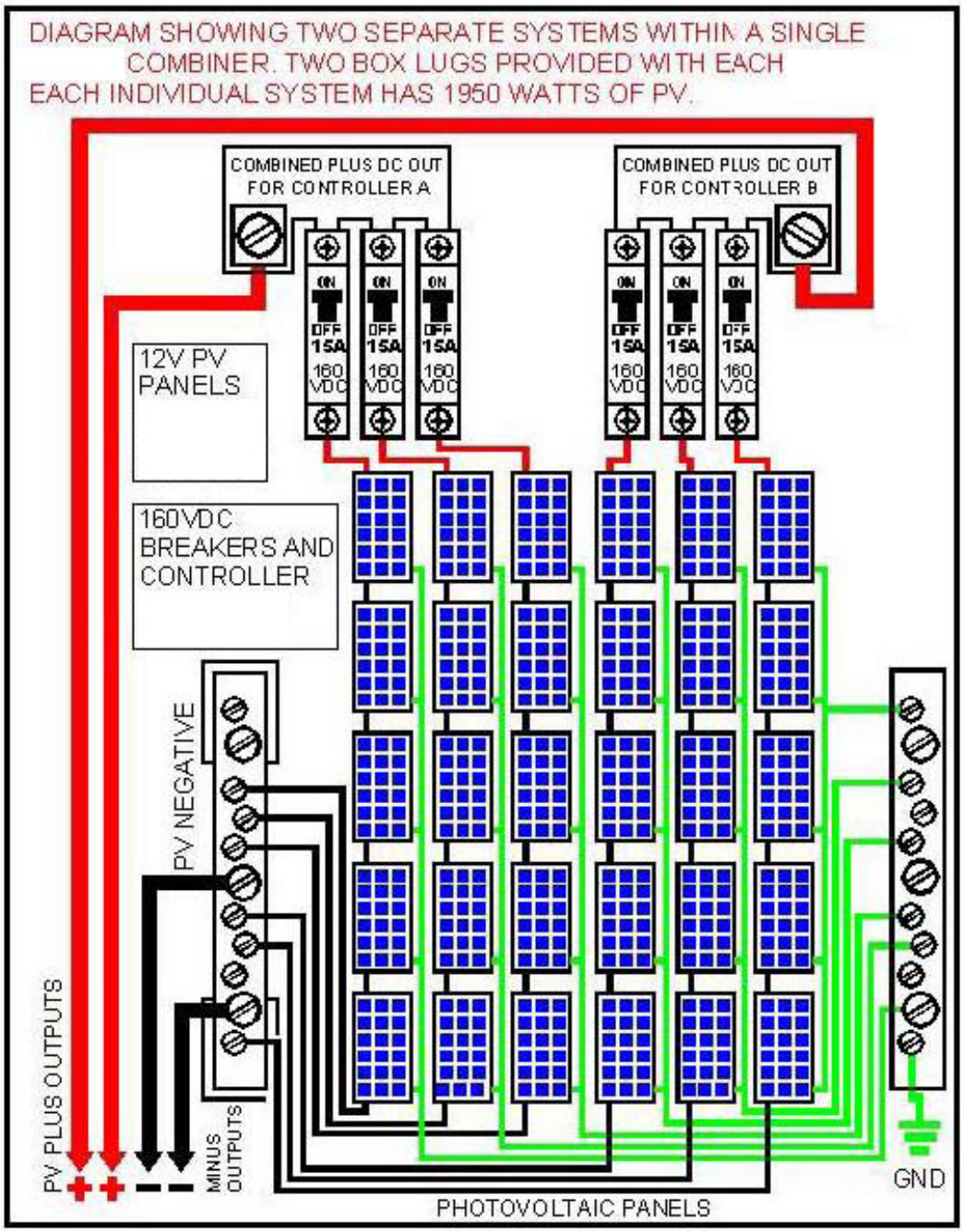
3-079-1 Bus-bar, Fuse Holder

The following wiring diagrams are intended to help you decide which type of combiner installation to do.

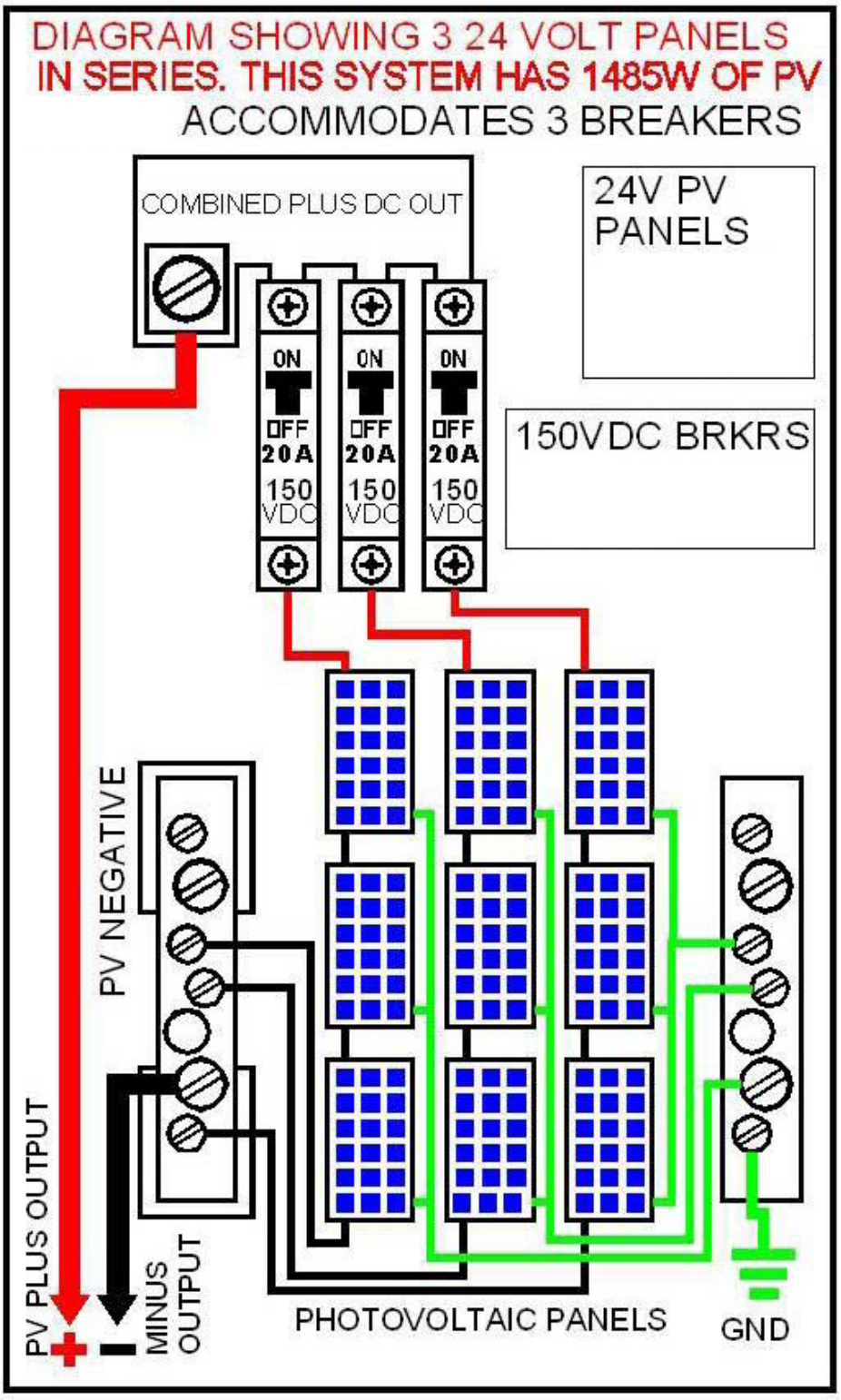
Factors:

- Battery bank of 24 Volts
- Six 24 Volt PV modules
- Charge controller that allows the freedom to change PV array voltages

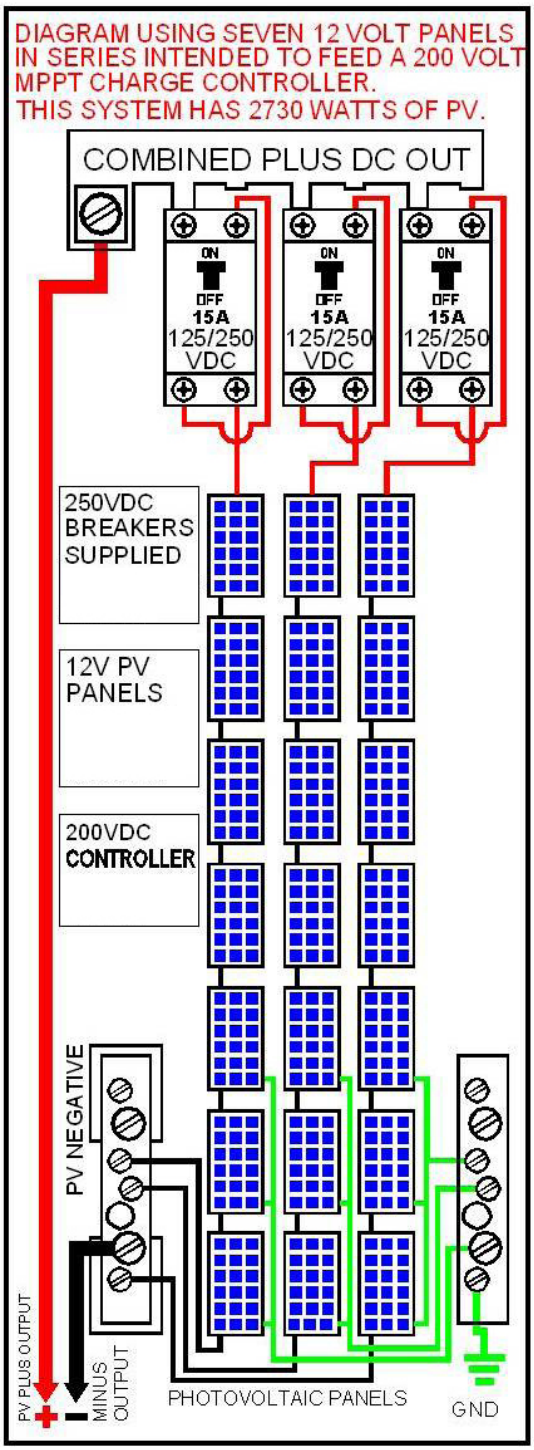
1. This array could have all 6 panels hooked in parallel using the SE-PV6 combiner and six SE-PVB15 breakers. This array would be ok if situated close to the battery bank. It requires larger wires than higher voltage arrays, but has the advantage of temporarily directly connecting to the battery bank in case the controller fails.



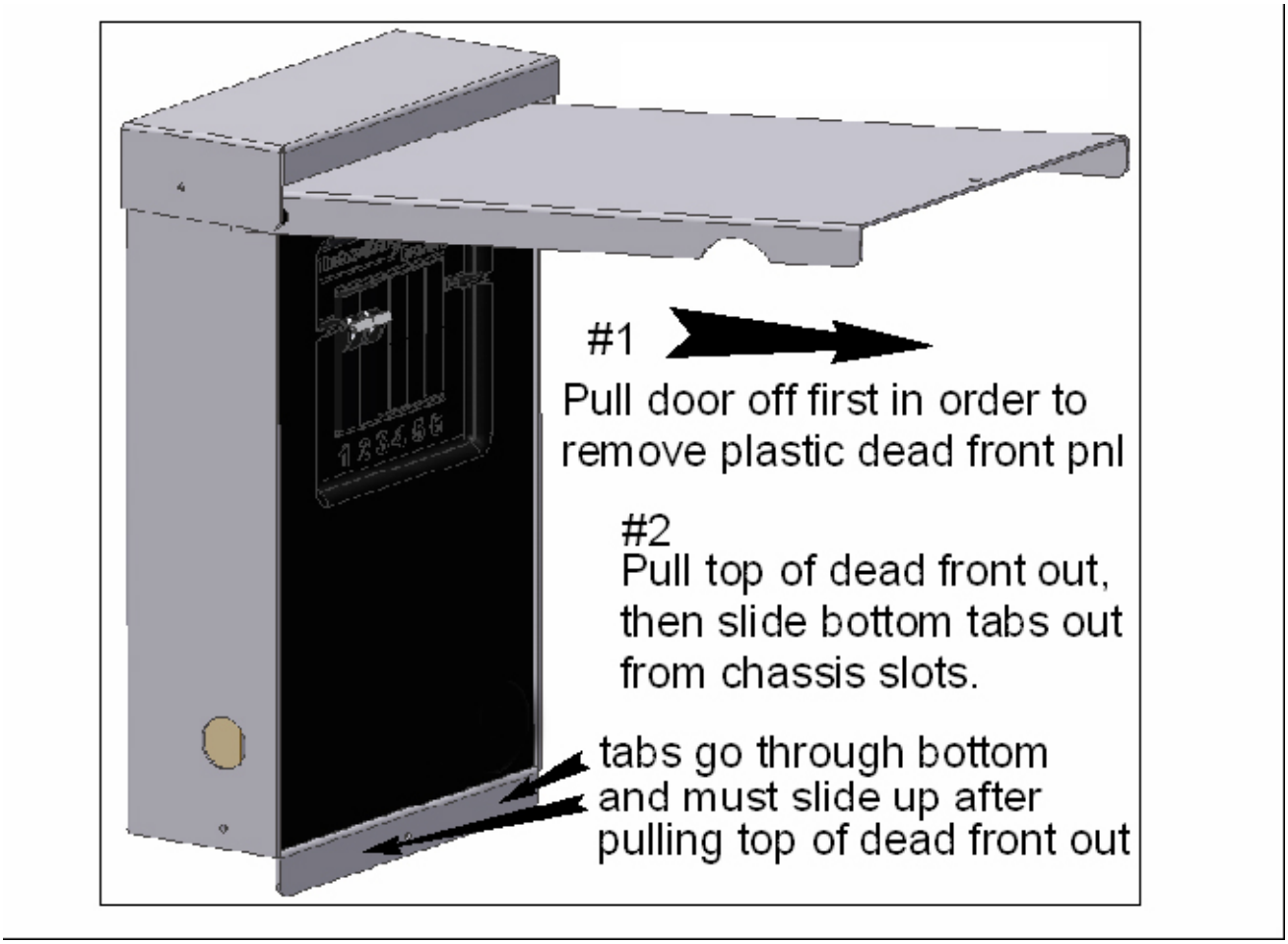
2. The array could be wired in three strings of two panels in series for a 48 volt nominal array. This is a very common installation and could be made in the SE-PV3 with three breakers. This is safe from a cold VOC standpoint, but you cannot directly connect it to the battery bank. If the PV array is between 30 and 100 feet from the battery bank, this set-up may offer the best power production.



3. The array could also be hooked up in two strings of three modules in series. The SE-PV3 and two breakers will accommodate this array. There is room to grow this system without adding another combiner if only three more modules are added later. Combiners can also be combined for additional power, so if six modules or more get added later, you can simply add an additional SE-PV3. When putting three 24V modules in series you must pay attention to VOC during cold spells so that you do not over-voltage the controller. This configuration works very well especially when the array is far away from the battery bank.



To remove the dead front:


#1
Pull door off first in order to remove plastic dead front pnl
#2
Pull top of dead front out, then slide bottom tabs out from chassis slots.
tabs go through bottom and must slide up after pulling top of dead front out

Remove the outer cover by pulling straight out when opened. The dead front will then come out easily.

MPPT CHARGE CONTROLLER MX60

The OutBack MX60 Maximum Power Point Tracking (MPPT) charge controller enables your PV system to achieve its highest possible performance.

Rated for up to 60 amps of DC output current, the OutBack MX60 can be used with battery systems from 12 to 60 vdc with PV open circuit voltage as high as 125 vdc. The MX60's setpoints are fully adjustable to allow use with virtually any battery type, chemistry and charging profile.

The OutBack MX60 allows you to use a higher output voltage PV array with a lower voltage battery - such as charging a 24 vdc battery with a 48 vdc PV array. This reduces wire size and power loss from the PV array to the battery/inverter location and can maximize the performance of your PV system.

The OutBack MX60 comes standard with an easy to use and understand display of the PV system's performance. The four line, 80 character, backlit LCD display is also used for programming and monitoring of the system's operation.

The OutBack MX60 can also be connected to the OutBack MATE system controller and display to allow monitoring of up to eight MX60 controllers from a distant location - up to 300 feet away. The MATE also includes an opto-isolated RS232 port for connection to a PC computer for data logging and system monitoring.

SPECIFICATIONS	MX60
Output Current Rating	60 amps DC Maximum at 12, 24 or 48 VDC
Nominal Battery Voltage	12, 24, 32, 36, 48, 54 or 60 VDC (programmable)
PV Open Circuit Voltage	125 VDC Maximum
Standby Power Consumption	Less than 1 watt typical
Charging Regulation Methods	Five Stage: Bulk, Absorption, Float, Silent, Equalization
Voltage Regulation Setpoints	13 - 80 VDC
Equalization Voltage	Adjustable 1.0 to 5.0 VDC above Bulk Setpoint
Temperature Compensation	Programmable slope -2.0mV/^{O}C/Cell to -5.0mV/^{O}C/Cell
Voltage Step-Down Capability	Can charge a 12 or 24 VDC battery from a 48V nominal PV array
Power Conversion Efficiency	99.1% @ 40 amps Output 97.3% @ 60 amps Output
Digital Display	4 line 80 character backlit LCD Display
Remote Interface	RJ 45 Modular Connector CAT 5 Cable 8 wire
Operating Temperature Range	-40 to 60^{O}C Power derated above 25^{O}C
Environmental Rating	Indoor Type 1
Conduit Knockouts	Two 3/4 - 1" on the back; One 1" - 1 1/2 " on each side; Two 1" - 1 1/2" on the bottom
Warranty	Two years parts and labor Optional Extended Warranty
Dimensions	Enclosure: 14.5 " H x 5.75" W x 5.75" D Shipping box: 17.75" H x 10" W x 7" D
Shipping Weight	12 lbs. - 5.4 kg

Preliminary - Specifications subject to change without notice

12V Deep Cycle Gel Battery

SE-12RADG260

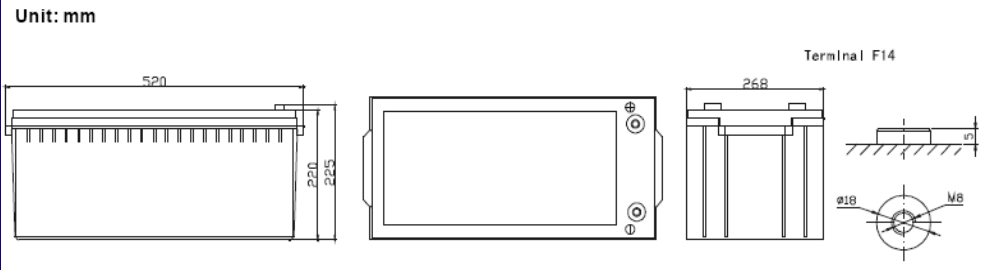
SPECIFICATIONS

Cells per Unit	6
Nominal Voltage	12V
Capacity	257Ah @ 10hr-rate to 1.80V per cell @ 25°C
Weight	~78.6 kg
Max. Discharge Current	1300A (5 sec)
Internal Resistance	~8 mΩ
Operating Temperature Range	Discharge: -30°C ~ +60°C Charge: -20°C ~ +50°C Discharge: -30°C ~ +60°C
Normal Operating Temperature Range	25°C±5°C
Float Charging Voltage	13.6 to 13.8VDC / unit average at 25°C
Recommended Maximum Charging Current Limit	78A
Equalization and Cycle Serve	14.1 to 14.3VDC / unit average at 25°C
Self Discharge	The batteries can be stored for more than 12 months at 25°C. Batteries should be charged before use. In higher temperatures, the time interval will be shorter
Terminal	Terminal F14
Container Material	A.B.S. (UL94-HB) Flammability resistance of UL94-V1 is available upon request

MH28533

EMC tested

ISO9001:2000 Certificate



Constant Current Discharge Characteristics Unit: A(25°C)

F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
1.60V	890	638	464	274	158	97	63	53	41	30	26.4	13.9
1.67V	866	607	454	269	157	96	63	52	41	30	26.1	13.7
1.70V	816	585	447	267	156	96	63	52	41	29	25.9	13.4
1.75V	733	540	426	260	154	95	62	52	40	29	25.6	13.2
1.80V	661	492	393	249	151	93	61	50	40	29	25.4	12.9
1.85V	576	440	352	233	143	89	58	48	38	27	24.6	12.2

Constant Power Discharge Characteristics Unit: W(25°C)

F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
1.60V	1595	1166	859	515	301	186	122	101	80	58	49.4	26.1
1.67V	1563	1114	841	508	300	185	122	101	79	58	48.9	25.9
1.70V	1475	1077	830	502	298	184	121	100	79	57	48.7	25.6
1.75V	1328	995	791	491	295	182	120	100	78	57	48.2	25.4
1.80V	1195	904	727	468	287	179	117	97	77	55	47.7	25.1
1.85V	1031	802	649	439	272	171	112	92	73	53	46.1	24.1

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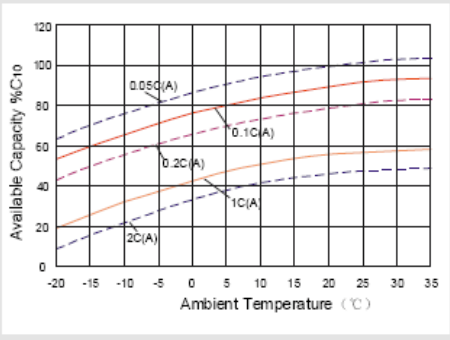
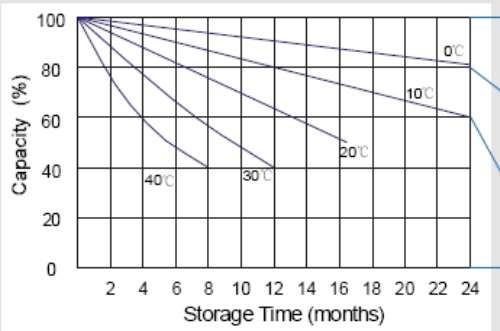
12V Deep Cycle Gel Battery

SE-12RADG260

Temperature effects curve



Storage characteristic



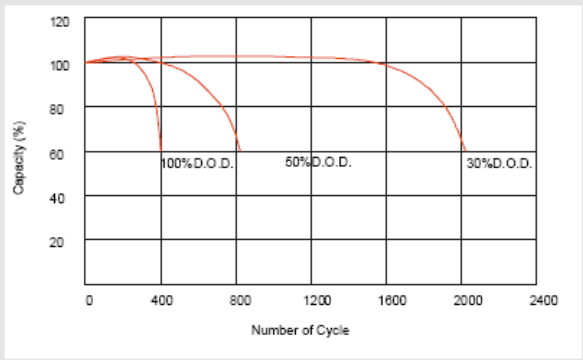
Supplementary charge required (Carry out supplementary charge before use if 100% capacity is required)

Supplementary charge required before use. This supplementary charge will help to recover the capacity and should be made as early as possible.

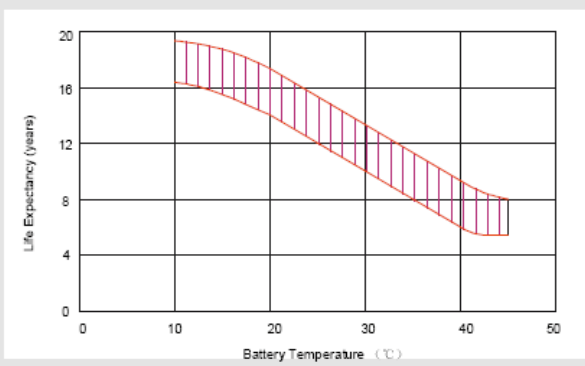
Supplementary charge may often fail to recover the capacity. The battery should never be left standing till this state is reached

Supplementary charge and storage guidelines

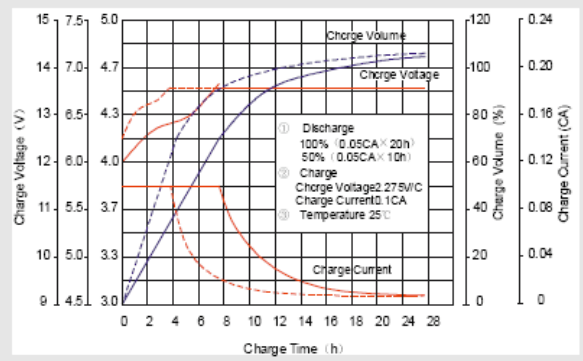
Life characteristics of cyclic use



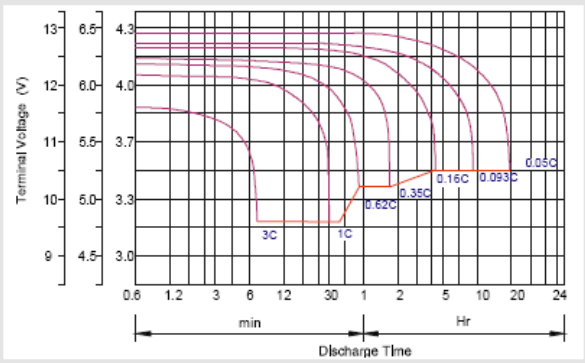
Effect of temperature on long term float life



Charge characteristic Curve for standby use



Discharge characteristic Curve



Charging Procedures(12V series)

Application	Charge Voltage (V)			Max. Charge Current
	Temperature	Set point	Allowable range	
Cycle Use	25℃	14.2	14.1~14.3	0.3C
Standby	25℃	13.7	13.6~13.8	0.3C

Charge the batteries at least once every six months, if they are stored at 25°C.

Charging Method:

Constant Voltage	-0.2Cx2h +14.1~14.3V,24h,Max. Current 0.2CA
Constant Current	-0.2Cx2h +0.1CAx12h

Discharge Current VS. Discharge Voltage

Final Discharge Voltage V/cell	1.75V	1.70V	1.60V
Discharge Current (A)	(A) ≤0.2C	0.2C< (A) <1.0C	(A) ≥1.0C

Charging Procedures(6V series)

Application	Charge Voltage (V)			Max. Charge Current
	Temperature	Set point	Allowable range	
Cycle Use	25℃	7.10	7.05~7.15	0.3C
Standby	25℃	6.85	6.8~6.9	0.3C

specifications are subject to change without notice

"bringing renewable
& efficient alternatives
to home environments"

BREATHE SYSTEMS®

www.breathesystems.com

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Typical 5.0kw-7.2kw, 120/240VAC, 60Hz Grid-Tie PS2 Power System

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Postage

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OutBack Power Systems

GRID-TIE / UTILITY INTERACTIVE CAPABLE

MODULAR

RUGGEDIZED

TRUE SINEWAVE

MULTI-FUNCTIONAL

INVERTER / CHARGERS

GTFX Series
Sealed Grid-Tie
Environmentally Tolerant
GTFX2524/ GTFX3048

GVFX Series
Ventilated Grid-Tie
Bug Proof / Filtered /Screened
GVFX3524 / GVFX3648

Made in USA

GRID TIE / UTILITY INTERACTIVE CAPABLE

Able to sell solar, wind or hydro power back to the utility grid - Reduce your utility bill by spinning your meter backwards!

PROVIDES UTILITY BACK-UP POWER

Keeps your lights on when the power goes out as well as other loads like wells,TV, fridge, computer, garage door opener, alarm etc,.

WORKS AUTOMATICALLY

Built in transfer switch automatically disconnects the house loads from the utility grid and powers them from the inverter during an outage.

SAFE AND APPROVED

Listed to UL1741 standard as a non-islanding power inverter system for renewable energy applications.

ULTRA CLEAN AC POWER

Smooth, true sinewave AC output waveform - not a course stepped sinewave or modified square wave.

INTELLIGENT BATTERY CHARGER

Advanced charging algorithms provide fast recharging while increasing battery life up to 10 years.

FIELD SERVICEABLE

Both FX and VFX inverter/chargers can be upgraded or serviced - even in the field.

NETWORKED COMMUNICATIONS

All of OutBack products can be connected through a HUB to form a network with monitoring and control via a single MATE display

CAPABLE TECH SUPPORT HELP

You can call or email and ask questions of the engineers that designed your products - Tech support doesn't get any better than that.

FEATURES:

ZERO watts of AC power draw at night - automatic "silent" sell mode built in.

Daily energy production on par with battery-less grid-tie inverter systems

Modular configuration allows easy system expansion and flexible design with up to 10 inverters interconnected.

Integrated communication between the inverters and the charge controllers ensure proper operation

Automatically optimizes the conversion effeciancy by matching the number of inverters to the amount of power being sold or used.

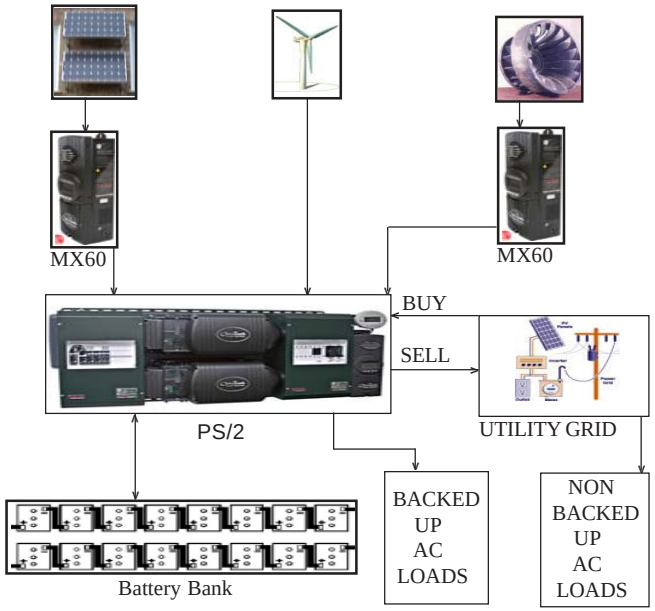
COMPARISON OF OTHER GRID-TIE INVERTER

Feature	OutBack	Brand X	Brand S
Grid - Tie / Utility Interactive	YES	YES	YES
Utility Back-up Capable	YES	YES	NO
Built in Battery Charger	YES	YES	NO
Built in AC Transfer Switch	YES	YES	NO
Compact Size	YES	NO	YES
Network Communication	YES	NO	YES
Single, Split or 3 PH Back-up	YES	YES	NO
Tolerant of Partial Shading	YES	YES	NO
Zero Watts of AC Power Draw at Night	YES	NO	YES
Programmable AUX Output	YES	YES	NO
Generator Start System	YES	YES	NO
Bugproof / Tropicalized	YES	NO	YES
Sealed Construction	YES	NO	YES
Modular Construction	YES	NO	YES

DOMESTIC VERSION - 120VAC 60Hz

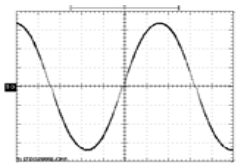
Inverter/Chargers Model No.	GTFX2524	GTFX3048	GVFX3524	GVFX3648
Continuous Power Rating 25° C	2500W	3000W	3500W	3600W
Nominal DC Input Voltage	24	48	24	48
Nominal AC Input Voltage/Frequency	120VAC / 60Hz			
Continuous AC RMS Output Current	21 amps	25 amps	29amps	30 amps
Idle Power (Sleep-<3watts)	18-20W	21-23W	18-20W	21-23W
Efficiency at 75% power & 25° C	91%	92%	91%	92%
Total Harmonic Distortion (typ/max)	2% / 5%			
Output Voltage Regulation	±2% TYP			
Surge Power Peak (1mSec) AC	70 amps	70 amps	70 amps	70 amps
Surge Power RMS (100mSec) AC	50 amps	50 amps	50 amps	50 amps
Overload (from 25° C start) 5 sec	4800W	4800W	4800W	5000W
Overload (from 25° C start) 30min	3200W	3200W	3200W	4000W
Automatic AC transfer Relay	60 amps AC			
AC Input Current (adjustable limits)	60 amps AC (Max)			
AC Input Voltage Range	108-132 VAC (Grid-Tie Mode)			
Frequency Range - AC Input	59.3-60.5 Hz (Grid-Tie Mode)			
DC Input Range	20-33V	40-66V	20-33V	40-66V
Recommended DC Breaker	OBDC-175	OBDC-100	OBDC-250	OBDC-175
Continuous Battery Charger amps DC	55	35	85	45
Shipping Weight	66 Lbs / 30kg		62 Lbs / 28kg	

GTFX VERSIONS INCLUDE THE FX-TURBO STANDARD

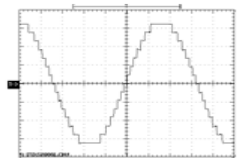


WAVEFORMS

Typical OutBack
GTFX or GVFX series
AC output waveform



Typical Xantrex
SW or SW+ series
AC output waveform



OutBack Power Systems

HUB-4 and HUB-10
System Communication Manager

Installation and User Guide

Please check our website at www.outbackpower.com for the latest product information

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INTRODUCTION

The OutBack Power Systems HUB-4 and HUB–10 System Communications Manager allows the interconnection of up to ten OutBack power conversion devices with the OutBack MATE. The interconnection creates a completely integrated Power System that is coordinated and managed by the MATE.

The OutBack HUB communicates stacking phase, load share, incremental start-up and shut down information directly between the inverters. Interconnection cabling is standard CAT5 eight wire with RJ45 modular jacks. The HUB is powered via any FX inverter/charger or MX60.

The OutBack HUB-4 allows the MATE to control any combination of four FX series inverters/chargers and MX60 charge controllers. The OutBack HUB-10 allows the MATE to control up to eight FX series inverters/chargers or up to 10 devices of any combination.

Kit contents:

HUB System Communications Manager

Wiring Cover

(2) #10 x ½" Philips head mounting screws

(2) Snap-in 1" conduit bushings

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INSTALLATION

The OutBack HUB is designed for surface mounting in an Indoor location.

The cabling from the HUB to the FX inverters/chargers, MX60 PV MPPT charge controller and MATE uses standard CAT5 type computer cable. Consult your local inspector for specific installation requirements. The current and voltage in the communication cable is limited to less than 30 volts DC and considered to be a "limited energy circuit". No conduit should be required.

The HUB utilizes a snap on wiring cover to protect cabling, eliminate accidental unplugging of cables, and to provide a clean looking installation. This solid black cover unsnaps with a screw driver gently prying in the provided slots.

Three phase stacking only

The OutBack HUB is shipped from the factory setup for series (120/240 VAC split phase) and/or parallel (120 VAC or 230 VAC single phase) stacking. If three phase stacking is desired, the cover must be removed and a jumper position changed. The procedure for this is as follows:

1. **Remove the black snap on wiring cover and all cables plugged into the HUB. Label the cable if you think you might confuse them.**
2. **Remove the four philips head screws from the bottom of the HUB. See Figure 1.**
3. **Remove bottom cover and remove the four philips head screws holding the green PCB to the upper cover. See Figure 2.**
4. **Move the plug-in jumper from the series/parallel location to the three phase location. See Figures 3 & 4.**
5. **Replace PCB and bottom cover.**

Figure 1

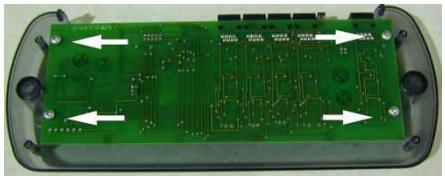
Figure 2

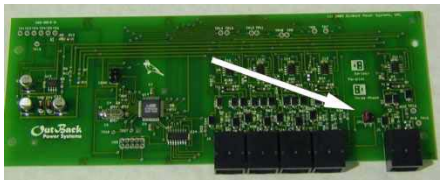
Figure 3

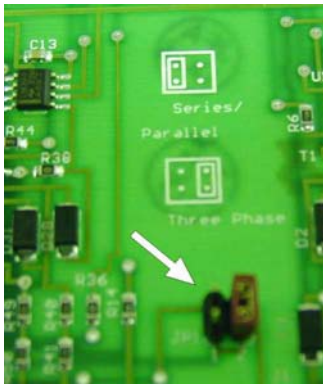

Figure 4

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MOUNTING

The OutBack HUB can be wall mounted in any orientation, also the OutBack PS2AC has mounting holes for the HUB incorporated in to it.

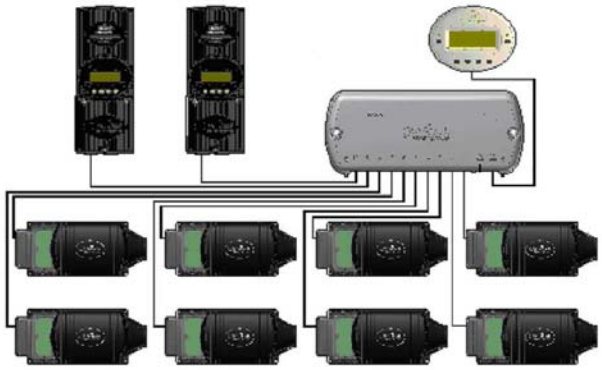
Typical Wall Mount

PS2AC Mounting

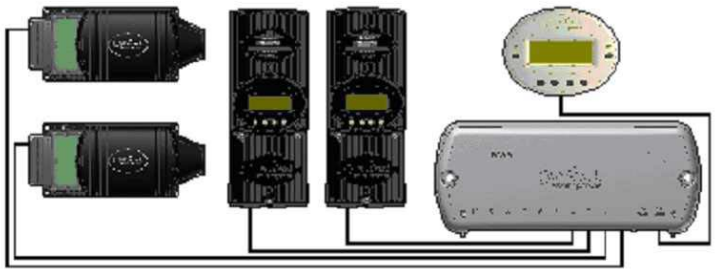
When mounting to an OutBack PS2AC, use the supplied #10 sheet metal screws to attach the HUB to the side of the PS2AC. Remove one or more of the two 1" knockouts, and insert the snap in conduit bushings supplied with the HUB.

COMMUNICATION NETWORK CONFIGURATION

TYPICAL HUB-10 CONFIGURATION



TYPICAL HUB-4 CONFIGURATION



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WIRING ORDER

Once mounted, cables can be connected to the HUB. The OutBack HUB has 4 to 10 RJ45 jacks (hence called Ports) that allow multiple OutBack products to be attached. These ports are numbered 1 to 10. The port labeled 1st MATE is for the OutBack MATE to be plugged into. Due to the large number of possible HUB wiring combinations, it is suggested that OutBack devices to be connected be installed using one of the following methods. Connections can be made with the FX inverter/charger or MX60 MPPT charge controller powered up. For the FXs output breakers should be open until stacking programming is complete. The OutBack MATE should always be plugged in last.

NOTE: To allow operation of the HUB, at least one OutBack power conversion device must be plugged into Port 1.

Single FX or MX

If only a single OutBack FX inverter/charger or a single MX60 MPPT charge controller is to be used, it should be plugged into Port 1 of the HUB. Additional OutBack inverters, controllers or other future OutBack devices such as the OutBack Smart Shunt can be plugged into any port.

Multiple FXs non-stacked

Multiple FX inverters/chargers can be plugged into any port as long as at least one FX is plugged into Port 1. Other OutBack devices can be plugged into any of the unused ports.

Multiple MX60 controllers

Multiple MX60 MPPT charge controllers can be plugged into any port as long as at least one is plugged into Port 1. Other OutBack devices can be plugged into any unused ports.

Single/parallel phase stacked

When connecting a "series-parallel stacked" inverter/charger system to a HUB, the FX inverter/charger that is to be the master ***must*** be plugged into Port 1. For clarity, any additional FXs should occupy the adjacent Ports. Other OutBack devices can be plugged into any of the unused ports.

Some PC monitoring software requires that 120/240 VAC series stacked or series-parallel stacked FX inverter/charger systems be wired with all LEG 1 (L1) phased FXs as odd numbered Ports and all LEG 2 (L2) phased FXs as even numbered Ports. This arrangement also makes programming of the power save level settings of the slave FXs more intuitive.

Three phase FX stacking

When connecting a three phase stacked system the FX inverter/charger that is to be the master (Phase A) ***must*** be plugged into Port 1. The phase B slave ***must*** be connected to Port 2, and the phase C slave ***must*** be connected to Port 3. The HUB jumper must be in the three phase position as described in the *Three phase stacking* section. Other OutBack devices can be plugged into any unused ports. Currently, only three inverters can be configured in a three phase arrangement – but additional non-stacked inverters can be plugged into any of the unused ports of the HUB.

Connecting the MATE

THE OUTBACK MATE SHOULD BE CONNECTED LAST. It also must be connected to the jack labeled "1st MATE". If any of the OutBack devices plugged into the HUB are powered, the MATE will power up as soon as it is connected. Upon powering up, the MATE will display a greeting and the software revision information. Immediately following this revision screen the MATE will display "Searching for Devices - HUB Found". If the MATE does not find the HUB, check all wiring, make sure power is applied to all connected devices and try again. (See Troubleshooting Section)

After the device found screen, the MATE will display a Port Assignment screen. Verify the device wiring with the Port Assignment screen.

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Pretty lights

When the first OutBack product that is powered plugs into the HUB, the HUB will go through a power up sequence that flashes all of its LEDs. The POWER LED will remain on any time that one or more OutBack products that are powered are plugged in. After the MATE is plugged in, it will start communicating with all of the connected devices. Each Port has an LED associated with it that is visible through the cover. Any device that is plugged in should have a flickering LED when the MATE is communicating with it.

Wiring Cover Knockouts

The OutBack HUB has a wiring cover that has knockouts relieved into the plastic. Using a sharp knife, simply cut out the desired knockout for the MATE cable to pass through.

Reinstall the wiring cover by snapping it over the posts on the side of the HUB.

CONGRADULATIONS! Your OutBack Power Systems HUB is now installed.

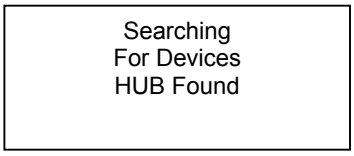
HUB OPERATION

The OutBack HUB is designed to interconnect multiply OutBack Power Systems products to an OutBack MATE. This section will describe the operation of the MATE as it applies to the HUB, please see the MATE User Manual for more information.

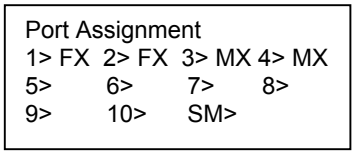
In order to operate correctly, the HUB requires that the MATE be code version **2.0** or higher. (See 'Checking the MATE Version' in the Troubleshooting section)

Using the OutBack MATE with a HUB

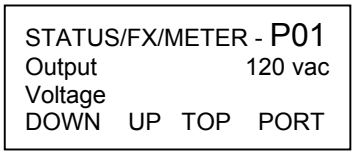
When the MATE is plugged into the HUB, immediately after the MATE displays the greeting screens, 'Searching For Devices' should be displayed, along with 'Hub Found'.



Next the Port Assignment screen will be displayed, along with the ID of any connected OutBack Devices. In the example to the right, two FXs and two MXs are connected to the HUB.



While navigating the various screens and menus in the MATE, the information displayed often only applies to a single device on a single Port. In these cases the Port number is displayed in the upper left hand corner of the MATE screen. To navigate through the Ports, use the 'PORT' button, usually the left most lower button.



Refer to the Troubleshooting section if any problems are encountered.

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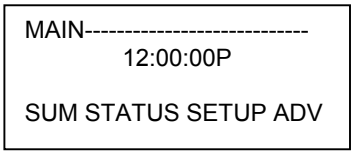
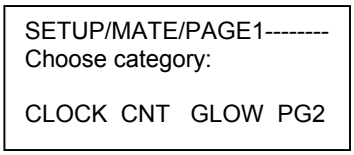
Adding a Device to an operating HUB

Any time an OutBack device is removed or added to a HUB, or its' Port is changed, the MATE must re-poll the system to find the locations of all the new or moved devices. This is accomplished by either unplugging and re-plugging the MATE from the HUB, or by the following procedure:

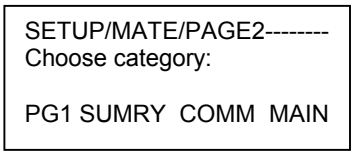
- Make sure the MATE display is on its' Main screen. Press and hold both lower left buttons simultaneously to return to the Main page from anywhere in the menus.



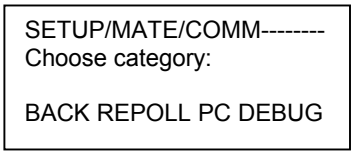
- Press the SETUP button then MATE to go to the SETUP/MATE screen



- Press PG2 and then COMM to go to the SETUP/MATE/COMM screen.



- Press REPOLL to have the MATE find any new or moved OutBack products.



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Hub power LED does not light	The HUB is powered from other OutBack power conversion devices (FX or MX). Make sure that the DC breakers for all OutBack products connected to the HUB are on. Check or replace CAT5 cables running from the HUB to the OutBack products.
MATE does not find the hub	Check the revision screen on power up of the MATE. Code version must be 2.0 or higher. Check or replace CAT5 cables running from the HUB to the OutBack products, as well as the cable from the MATE to the HUB.
MATE does not see all connected devices	Verify that all connected devices have DC power applied and are functioning properly. Check or replace CAT5 cables running from the HUB to the OutBack products. If any OutBack products were added or moved on the HUB follow the instructions in 'Adding a Device to an Operating HUB' section.
MATE displays a 'COMM ERROR'	If the MATE receives too many interrupted or corrupt communications with OutBack products attached to the HUB, it will display a 'COMM ERROR' screen. Choosing 'VIEW DEBUG' takes you to a screen that lists all ports and accumulated errors. Any Port experiencing errors can be found by the error count after the Port number. In the example to the right, Port 4 has a large number of errors detected (04:025 means Port 4: showing 25 errors). Pressing any key will take you to the SETUP/MATE/COMM screen, which will allow the error counts to be reset using the 'RSET' button, the Debug screen can be redisplayed by using the 'VIEW' button, or user can get back to the SETUP menu by using the 'BACK' button. Use the information on the Debug screen to locate the problem device. Make sure that its' DC breaker in on, and that is operating correctly. Check or replace CAT5 cables running from the HUB to that device.

00:000	01:000	02:000
03:000	04:025	05:001
06:001	07:001	08:001
09:001	10:001	2M:001

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MATE / HUB CABLES

OBC-3 Three foot cable with green jacket

OBC-6 Six foot cable with green jacket

OBC-50 Fifty foot cable with green jacket

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OutBack Power Systems

Two Year Limited Warranty

OutBack Power Systems Inc. warrants that the products it manufacturers will be free from defects in materials and workmanship for a period of two (2) years subject to the conditions set forth below.

The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product.
OutBack Power Systems' liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at OutBack Power Systems' discretion. OutBack Power Systems does not warrant or guarantee the workmanship performed by any person or firm installing its products.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE (OR JURISDICTION TO JURISDICTION). OUTBACK POWER SYSTEMS' RESPONSIBILITY FOR MALFUNCTIONS AND DEFECTS IN HARDWARE IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD SET FORTH ABOVE AND NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER SUCH PERIOD. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

OUTBACK POWER SYSTEMS DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT OR LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

During the two year period beginning on the invoice date, OutBack Power Systems will repair or replace products covered under this limited warranty that are returned to OutBack Power Systems' facility or to an OutBack Power Systems authorized repair facility, or that are repaired on site by an OutBack Power Systems authorized repair technician. To request limited warranty service, you must contact OutBack Power Systems at 360-435-6030 within the limited warranty period. If limited warranty service is required, OutBack Power Systems will issue a Return Material Authorization (RMA) Number. Mark the outside of the package with the RMA number and include a copy of the purchase invoice in the package. You must ship the products back to OutBack Power Systems in their original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. OutBack Power Systems will ship the repaired or replacement products to you freight prepaid if you use an address in the continental United States, where applicable. Shipments to other locations will be made freight collect.

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19009 62nd Ave NE, Arlington WA 98223 USA
Tel 360 435 6030
Fax 360 435 6019

SYSTEM MANAGEMENT REMOTE MONITOR AND CONTROL MATE

The OutBack MATE is a complete system controller and display for both the OutBack FX2000 inverter/charger and MX60 MPPT PV charge controller. It provides a display of the operation as well as allows control and adjustment of the setpoints. The OutBack Mate also coordinates the operation of the entire system to maximize performance and to prevent multiple products from conflicting.

A single OutBack MATE is able to connect to multiple FX2000 inverter/charges, MX60 MPPT PV charge controllers and any other OutBack power conversion and control products offered in the future. A maximum of ten OutBack products will be able to be connected to a single MATE via CAT 5 / ethernet type cabling with 8 wire RJ45 modular connectors and the OutBack HUB communication manager.

The OutBack MATE includes a 4 line backlit LCD display with 80 alphanumeric characters. This allows multiple measurements to be displayed at the same time and reduces the amount of abbreviations required, simplifying the operation and reducing confusion. All of the programmed setpoints are stored in permanent memory to eliminate the need to reprogram the system after a shutdown or battery replacement.

The OutBack MATE also includes a built in real time clock and calendar which allows programming of the inverter operation based on the time of day and even day of the week. This can be used to allow the system to work with time-of-day power rates or to limit a generator's run time to a specific time period of the day or week.

The OutBack MATE also includes an opto-isolated RS232 port with a DB9 jack for connection to the serial port of a PC computer.

OutBack is working with several third party developers to offer Windows based software programs for datalogging and graphical display of the system's operation and performance. This PC computer software will be available separately and is expected in September, 2002.

Specifications	The MATE
Interface Display	4 line 80 character backlit LCD - Alphanumeric with graphic symbols
Control Keypad	6 backlit silicone membrane keys- dedicated inverter and AC input keys
Status Indicators	Two LED Status Indicators : Green = Inverter Yellow = AC Input
Communication Protocol	Proprietary OutBack Multi-drop using an OutBack HUB
Interconnection Cabling	Standard CAT 5 network cable with RJ45 modular jack - 50 ft included
PC Computer Interface	RS232 opto-isolated DB9 jack 9600 baud serial communication
Microprocessor	16 MHz low power consumption version
Setpoint and Data Memory	32K non-volatile flash RAM
Clock / Calendar	On-board real time clock with battery backup
Audible Indicator	2 KHz Transducer
Environmental Rating	Indoor Type 1 Optional outdoor Type 3R transparent lockable cover
Dimensions	5.75" W x 4.25" H x 2" D 14.6 cm x 10.8 cm x 5.08 cm
Shipping Weight	1 lb - 454 g
Warranty	Two years parts and labor Optional Extended Warranty

Preliminary - Specifications subject to change without notice

Outback - MidNight E-Panel

MNE-125AL-L

The MidNite Solar E-Panel comes standard with the basic over-current protection and disconnects required to install your renewable energy system. It can also expand to grow as your needs arise.

Inverter installation has just gone from hours to minutes with MidNite Solar's E-Panel. These disconnect boxes can easily be stacked horizontally or vertically to save space

Breaker: 125 Amp 125 VDC
Material: White Aluminum
Hinge Side: Left Side Hinge
Dimensions: 14" X 12" X 28"
Weight: 19 Lbs

Features

* Small size compared to existing disconnect and over current solution
* Pre-wired to save time, money and complexity. All field wiring connections clearly labeled
* White powder coated aluminum
* Easily expands to accommodate additional inverters
* Six slots for din rail breakers, PV, Wind, Hydro, AC distribution
* Pre-wired 50 amp 240VAC rated Inverter AC bypass switch
* Pre-wired 50 amp 240VAC rated AC Input disconnect
* Bus bars for Battery Plus, Battery Minus and ground
* Mounting hardware for Inverter and charge controller
* Mounting brackets for hanging E-Panel on wall
* Heavy duty 175 amp AC distribution block
* ETL listed to UL and Canadian standards
* Left hand hinged door to mount inverter
* Knockouts for AC and DC conduits
* Charge control bracket (CCB)
* Cut outs for two GFCI outlets
* DC Inverter battery breaker
* Internal inverter cables

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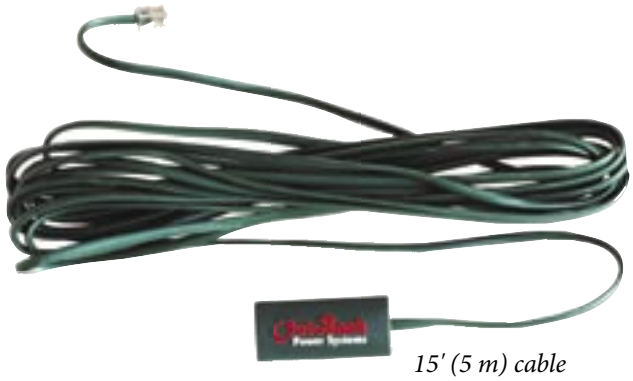
Remote Temperature Sensor

RTS

The OutBack Remote Temperature Sensor (RTS) is a necessary tool for proper battery charging. All OutBack products with integrated battery charging have a temperature compensation system built-in which benefits from the installation of the optional RTS. The RTS ensures that your OutBack system knows the precise ambient temperature so that it can recharge your batteries safely and efficiently. Systems with multiple OutBack products connected to one HUB4 or HUB10 require only a single RTS to be installed.



15′ (5 m) cable

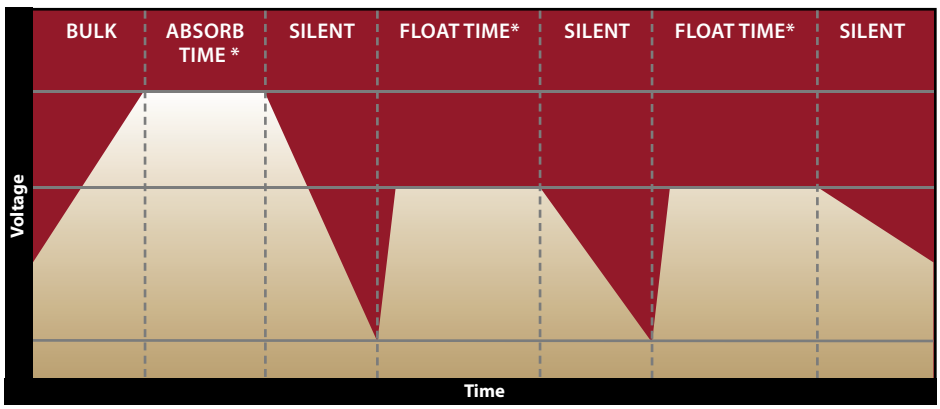
Battery Charging

Batteries are a key component in backup and off-grid systems, often serving as the only energy storage device. To guarantee that they function properly it is important that your batteries are maintained. A chief part of this maintenance is proper charging. Your batteries should always be maintained above a 50% level of charge and receive a complete recharge once a month to ensure operation at peak performance. Prolonged use of the battery below a 50% state of charge will adversely affect the long-term health of the battery and can result in premature failure.

The multistage charging process uses several regulation stages to allow fast recharging of the battery energy storage system while ensuring a long battery life, high performance and efficient operation of the overall system. The charging process begins with the BULK stage, where maximum current is sent to the batteries until the target "absorb" voltage is reached and the absorb stage of the charge begins. During ABSORB, the charger provides the batteries with the just enough current to hold at the set voltage for a preset amount of time. Following this cycle, the charging system changes between available OutBack charging products. Using the MX-60, the batteries enter the FLOAT stage where they are given a maintenance charge until there is no excess renewable energy. The FX or VFX inverter/charger will go into SILENT mode where the charger turns off until the battery voltage drops to the "re-float" setting. At this point the inverter/charger initiates the maintenance FLOAT charge. This method reduces fuel and utility consumption.

It should be noted that the temperature of your batteries has an impact on the charging process. The OutBack RTS should be used to monitor this. In higher ambient temperatures, the battery charging regulation settings will be reduced to prevent overcharging of the batteries. Conversely, in lower ambient temperature conditions, the regulation settings will be increased to ensure complete recharging of the batteries.

Batteries are composed of a group of individual cells. Through normal use, the charge of each individual cell will not be equal to the other cells. To address this, your batteries should be EQUALIZED either once each month or once every few months depending on usage. During the equalization charge the electrolyte in the battery is stirred up by gas bubbles, which help to create an equal mixture of water and acid. Simultaneously the full cells are overcharged which allows the low cells to "catch up" and all of the active material in the battery to be reconverted to its charged state. Depending on usage, the hardened battery plate material that is no longer active in the battery-sulfation can also be reduced by an equalization charge.

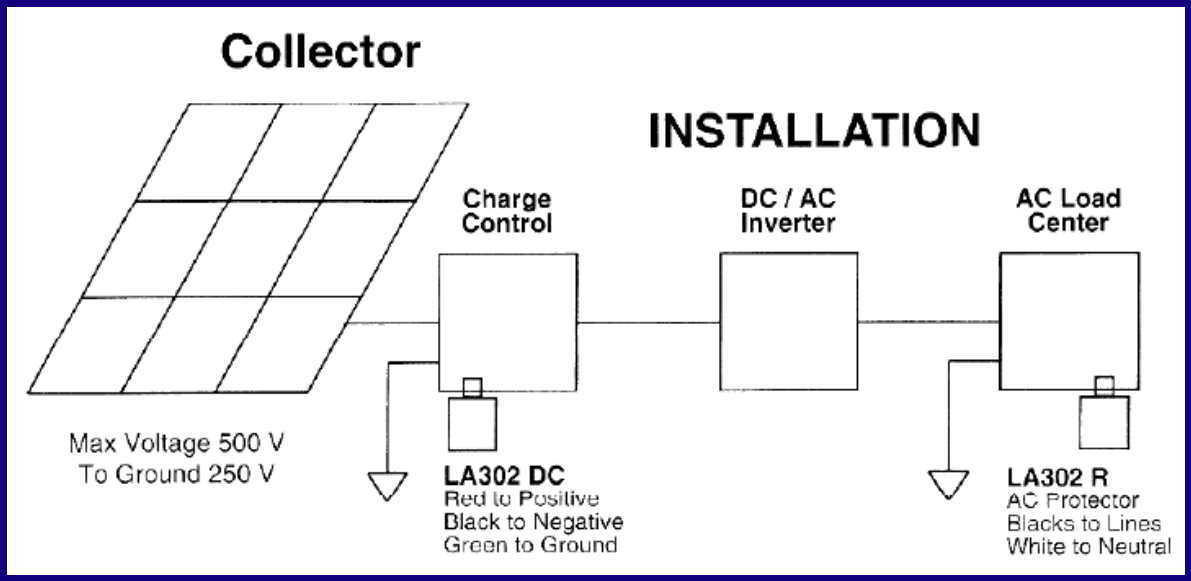


** MATE Adjustable*

Lightning Arrestors

SE-LA302-DC

Silicon Oxide Arrestor for Photovoltaic and other limited DC Current applications



Type of Design	Silicon Oxide Varistor
Maximum Current	60,000 Amps
Maximum Energy	2,000 Joules per Pole
Maximum Number of Surges	Unlimited
Response Time One Milliamp Test	5 Nanoseconds
Response Time to Clamp 10,000 Amps	10 Nanoseconds
Response Time to Clamp 50,000 Amps	25 Nanoseconds
Leak Current at Double the Rated Voltage	None
Case Material	36" #12 THHN
Case Material	PVC
Locknut and Washer Furnished	

SE-LA302 DC
SE-302 R

Conduction Characteristics (8 X 20 microsecond wave shape; ANSI; IEEE; NEMA Standard C62.1)

Discharge Current	5000A	10000A	20000A	40000A	60000A
Clamping Voltage	240V	480V	840V	1300V	2000V

Weatherproof Enclosure
DIMENSIONS: 2-1/4" High
2-1/4" Diameter

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Lightning Arrestors

SE-LA302-AC

With rapid response, high current Lightning Arrestors help prevent damage to computers and other electronic equipment

Type of Design	Silicon Oxide Varistor
Maximum Current	100,000 Amps
Maximum Energy	3,000 Joules per Pole
Maximum Number of Surges	Unlimited
Response Time One Milliamp Test	5 Nanoseconds
Response Time to Clamp 10,000 Amps	10 Nanoseconds
Response Time to Clamp 50,000 Amps	25 Nanoseconds
Leak Current at Double the Rated Voltage	None
Case Material	36" #12 THHN
Case Material	PVC
Locknut and Washer Furnished	

SIMPLE INSTALLATION

Fasten the arrestor to the service entrance equipment. Connect the black wires to the lines below the main disconnect. Connect the white wire to the grounded neutral bus.

SE-LA303 for 100-208-250 Volt; 3-Phase; 3 or 4 Wire Service
SE-LA302 for 125-250 Volt; Single Phase; 3 Wire Service
SE-LA301 for 125-250 Volt; Single Phase; 2 Wire Service
SE-LA302R for Light Duty 125-250 Volt; Single Phase; 3 Wire Service

Conduction Characteristics (8 X 20 microsecond wave shape; ANSI; IEEE; NEMA Standard C62.1)

Discharge Current	5000A	10000A	20000A	40000A	60000A	80000A	100000A
Clamping Voltage	240V	480V	840V	1300V	2000V	3000V	4000V

(Unlimited Number of Operations for 5000A - 60000A; One Operation for 80000A-100000A)

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Cabling

SE40XLPOTPEU TüV Photovoltaic Cable (4.0mm2)

Design & Construction Data

Conductor

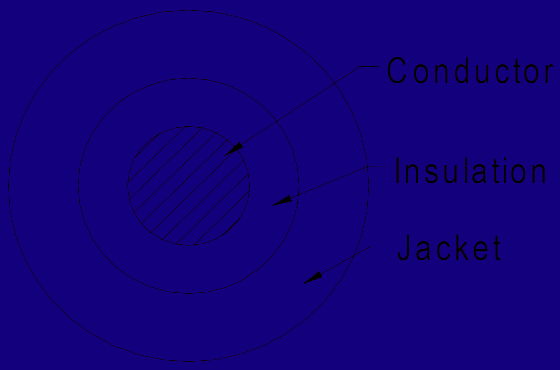
Number of Cond.	1
Material	Tinned Copper Wire
Construction	50 / 0.25

Insulation

Material	XLPO
Nominal Thickness	0.73mm
Nominal O.D.	3.5mm±0.15mm
Color	White

Jacket

Material	TPE-U
Nominal Thickness	0.95mm
Nominal O.D.	5.40mm±0.20mm
Color	1-Black; 2-Red; 3-Blue; 4-Yellow



Physical & Electrical Performance

Spark Test	3.0kV (for insulation)
Minimum Insulation Resistance	100 Mohm X km

Aging Test		Tensile Strength (minimum)	Elongation (minimum)
Insulation	Un-aged	1.05kg / mm^2	150%
	Aging (121°C X 168h)	70%	70%
Jacket	Un-aged	1.05kg / mm^2	150%
	Aging (121°C X 168h)	70%	70%

Dielectric Strength	5.0kV / 1min
Flame Test	Horizontal Flame
UV Resistance	According to International Standard
O-Zone Resistance	According to International Standard
Oil Resistance	According to International Standard
Flexibility at Low Temp. (-25°Cx4h)	No Crack
Current Rating	42A
Operating Temperature	-40°C ~ +90°C

CE

RoHS

TÜVRheinland®
Precisely Right.

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The cable is Halogen Free and complies with the RoHS Directive

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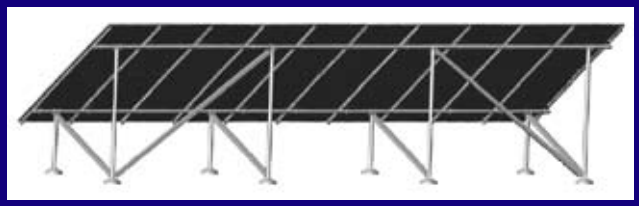
Solar Panel Mounting Systems

BREATHE Systems® Solar Panel Mounting Systems are built to withstand harsh conditions and are widely used in residential, commercial and remote districts. The mounting systems can be adapted to by almost all PV panels on the market today.

Pole Mounting

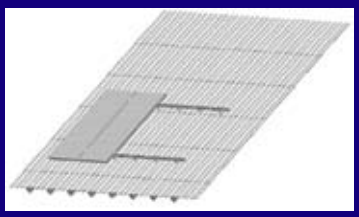
Our mounting systems meet international quality standards, such as ISO9001:2000, utilize the latest technology and are aesthetically pleasing. The systems are made from aluminum and stainless steel and the high corrosion resistance guarantees a long lifespan. Our mounting systems come with a 10-Year warranty.



Array Mounting

BREATHE Systems® provides installer manuals and install architecture codes. We have 24-Hour technical support lines and are able to provide engineers and technicians for hands-on and face-to-face consultations.

Roof Mounting



ISO

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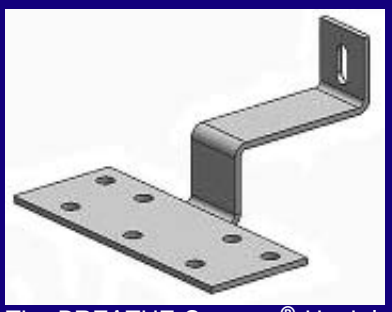
Solar Panel Mounting Systems



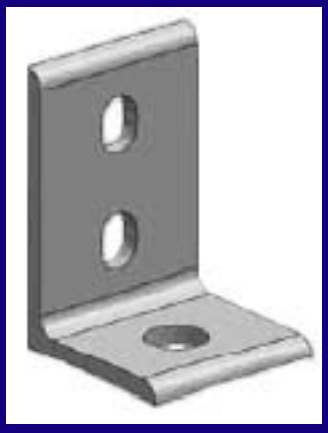
The BREATHE Systems® Hook is ideal for pitched roofs. The single slot hole on the hook side allows for variation in heights, whilst the seven holes are utilized to fasten the hook to the rafter.

The BREATHE Systems® can adapt to almost all solar panels on the market today. The top of the rail is used to support the solar panel, the bottom to fasten the rail to the roof and the middle part is for cabling.

The End Clamp is used to fasten the solar panel to the BREATHE Systems® Rail.

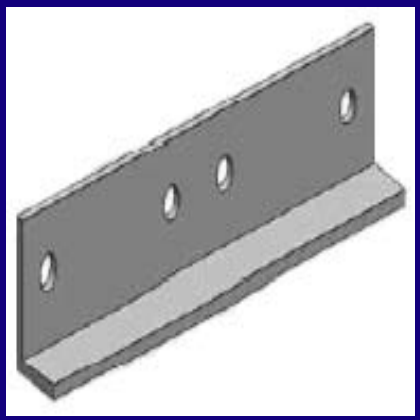
The Upper Clamp and T-Bolt fit the solar panel to the BREATHE Systems® Rail. The Upper Clamp clamps the frame of the solar panel.

The Lower Clamp is used underneath the panels and allows for adjustment to the space between the panels.



The L-Feet are commonly used in residential and commercial applications. L-Feet are suitable for angled rooftops. The solar panel can be set at two heights utilizing the two holes on the verticle side of the part. The higher height is generally used to allow for greater air flow around the solar panel in order to lower the panel temerature.

The Rail Splice Bar is designed to connect two BREATHE Systems® Rails for larger mounting systems



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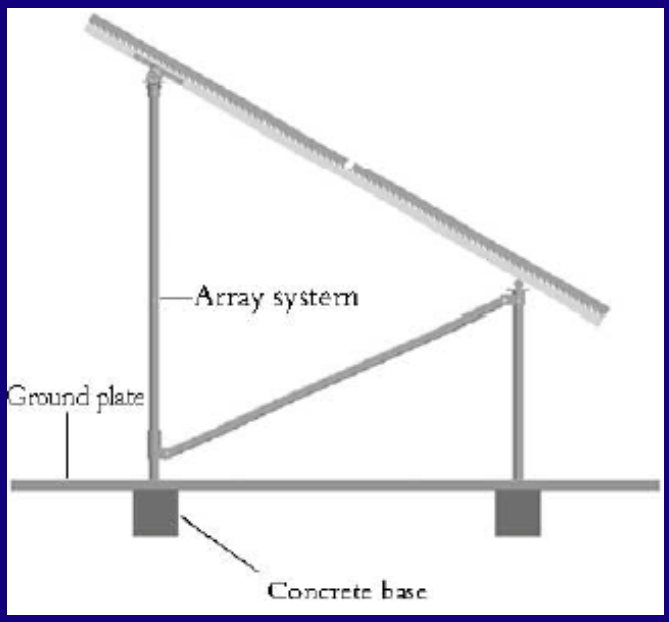
Solar Panel Mounting Systems

Array Mounting Systems

Array systems are designed for large photovoltaic systems in open areas or on flat roofs. Connection parts can be pre-fabricated in order to guarantee fast assembly.



Characteristics

- Total module surface up to 30 m2
- Maintenance-free
- Sound structure and long life
- Power capacity of approximately 5kW
- No movement; fixed system
- Designed to withstand wind speeds of up to 200 km/hr

BREATHE Systems® Array Mounting System		Number of Panels per Row										
		2	3	4	5	6	7	8	9	10	11	12
Component Description	Component Code	Quantity of Components										
BREATHE Systems® Rail	1001000 (1.0m)											
	1001800 (1.8m)											
	1002400 (2.4m)											
	1003000 (3.0m)											
	1003600 (3.6m)					4		5		6		7
Long Pole	500100					4		4		4		4
Short Pole	500101					4		4		4		4
Cross Strut	500102					2		2		2		2
Cross Brace (Long)	500103					2		2		2		2
Cross Brace (Short)	500104					2		2		2		2
Sleeve	500105					6		6		6		6
Front Cap	500106					6		6		6		6
Front Cap-2	500107					2		2		2		2
L-Feet	100901					8		10		12		14
Strut Plate	800803					16		20		24		28
Lower Clamp	100703					8		8		8		8
Plate Washer	500108					8		10		12		14
T-Bolt M8x20	900701					24		30		36		42
M8x20 Bolt	900905					8		8		8		8
M10x90 Bolt	900906					20		20		20		20
U-Bolt M12x62	900907					24		26		28		30
Grounding	930704					12		16		20		24

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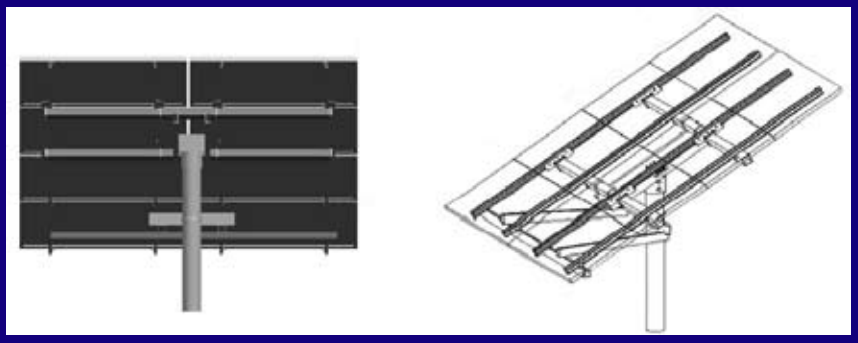
Solar Panel Mounting Systems

Pole Mounting Systems

Pole systems are designed for up to 1.6kW and to withstand wind speeds of up to 200 km/hr. These systems are suited for large photovoltaic system installations and are built for most wind zones. The system can be manufactured to your desired angle and welding is necessary at the installation destination. The instruction manuals provided enable clients an easy and quick installation.



Characteristics

- Total module surface up to 10.5 m2
- Maintenance-free
- Sound structure and long life
- Power capacity of approximately 1.6kW
- No movement; fixed system
- Designed to withstand wind speeds of up to 200 km/hr

BREATHE Systems® Pole Mounting System		Number of Panels per Row										
		2	3	4	5	6	7	8	9	10	11	12
Component Description	Component Code	Quantity of Components										
BREATHE Systems® Rail	1001000 (1.0m)											
	1001800 (1.8m)									4		
	1002400 (2.4m)									4		
	1003000 (3.0m)											
	1003600 (3.6m)							4				
Stand Pole	800801					1		1		1		
Cross Pole	800802					2		2		2		
Strut Plate	800803					2		2		2		
Pole Can	800804					1		1		1		
Pole Bracket	800805					1		1		1		
Leg Strut	800806					2		2		2		
Leg Strut-2	800807					1		1		1		
L-Feet	100901					4		4		4		
Large L-Feet	100903					8		8		8		
Tilt Strut	800808					2		2		2		
Space Bar	800809					8		8		8		
U Bolt	800810					1		1		1		
Square U Bolt	800811					8		8		8		
Lower Clamp	100703					24		32		40		
T-Bolt M8x20	900701					28		28		28		
T-Bolt M12x25	900802					8		8		8		
M20x50 Bolt	900903					4		4		4		
M12x45 Bolt	900904					6		6		6		
Grounding	930704					12		16		20		

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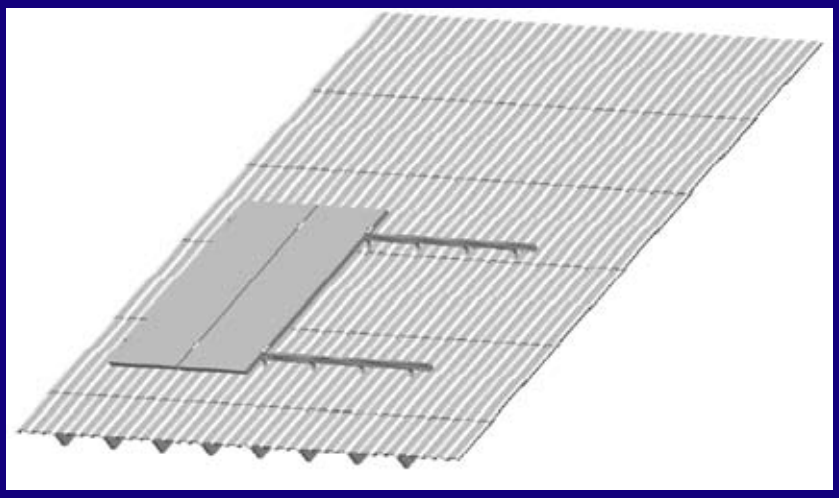
Solar Panel Mounting Systems

Roof Mounting Systems

Roof systems are designed for roofs of any pitch and also for flat roofs. Solar panels can be fastened to the roof using the BREATHE Systems® Rail. The L-Feet connect to the bottom of the rail, which mount to the roof. Minimum tools are required for installing the Roof Mounting System. Our detailed installation instructions ensure an easy and smooth installation.



BREATHE Systems® Rooftop Mounting System		Number of Panels per Row										
		2	3	4	5	6	7	8	9	10	11	12
Component Description	Component Code	Quantity of Components										
BREATHE Systems® Rail	1001000 (1.0m)											
	1001800 (1.8m)	2										
	1002400 (2.4m)				4	2			2			
	1003000 (3.0m)		2			2	4		4	6	4	
	1003600 (3.6m)			2				4			2	6
Upper Clamp	100701	2	4	6	8	10	12	14	16	18	20	22
End Clamp	100702	4	4	4	4	4	4	4	4	4	4	4
Rail Splice Bar	100801					2		2	6		6	
L-Feet	100901	4	6	6	8	8	10	12	14	14	14	16
Round Feed	100902	4	6	6	8	8	10	12	14	14	14	16
Lag	900201	8	12	12	16	16	20	24	28	28	28	32
T-Bolt M8x20	900701	12	14	14	16	16	18	20	22	22	22	24
T-Bolt M8x35	900703	2	4	6	8	10	12	14	16	18	20	22
T-Bolt M8x65	900801	4	4	4	4	4	4	4	4	4	4	4
M12x20 Bolt	900902	4	6	6	8	8	10	12	14	14	14	16
Grounding	930704	4	6	8	10	12	14	16	18	20	22	24

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